Impact of end-user search training on pharmacy students: a four-year follow-up study*

By Naomi R. Ikeda, M.I.L.S.*
Reference Librarian

Harvey Cushing/John Hay Whitney Medical Library
Yale University
333 Cedar Street
P.O. Box 3333
New Haven, Connecticut 06510-8014

Diane G. Schwartz, M.L.S.
Coordinator, Health Sciences Information Services

Alfred Taubman Medical Library
University of Michigan
1135 East Catherine Street
Ann Arbor, Michigan 48109-0726

The Alfred Taubman Medical Library at the University of Michigan has offered instruction in online literature searching to third-year pharmacy students as a component of the course "Drug Information and Scientific Literature Evaluation" since 1983. In the spring of 1989, a follow-up study was conducted to assess the impact of instruction on four classes of graduates. Of a pool of 151 graduates, 90 (60%) responded to a mailed questionnaire on their use of information and computerized literature searching. The respondents were divided into four subgroups: end-user searchers, users of intermediaries, end users who used intermediaries, and those who did not use computerized literature search systems. Seventy-two percent of the respondents used some type of computerized literature searching, and 42% performed their own searches. The four subgroups differed in general computer use, familiarity with MEDLINE search terminology, information use, reasons for using or not using literature searching, and characteristics of searches (i.e., type, time frame, amount, and frequency). Training in end-user search systems appears to have had an impact on the continued use of computerized literature searching several years after the formal educational program.

INTRODUCTION

Today's health scientists will encounter computerized information resources throughout their educational and professional lives. To function effectively in an increasingly technological world, the health sciences student must be well prepared to use these resources. Learning the fundamentals of these techniques should prepare the new health care professional to function capably in the complex technological world of the twenty-first century.

Among the resources presently available are the online public access catalog (OPAC), bibliographic databases, electronic textbooks, interactive computer-aided instructional programs, analytical research tools, and clinical patient information files and diagnostic programs. Many of these programs use similar search protocols, including Boolean operators, controlled vocabularies, and free-text searching.

Since the 1980s, the academic health sciences library has assumed an enhanced role as its institution's educator and administrator of information technology. Clearly, this is in part the new role for libraries and librarians described so effectively in the 1982

report by Matheson and Cooper [1] and followed up two years later in "Physicians for the Twenty-First Century" [2]. New responsibilities include taking a leadership role in integrating information management technology into continuing health professions education by teaching bibliographic database searching and personal file management. Such skills enable students to focus their attention on developing analytical and problem-solving techniques that will provide the framework for life-long learning skills [3].

To date, most libraries have focused their efforts on teaching students, faculty, and staff to search MEDLINE, the primary database of the biomedical sciences [4]. MEDLINE instructional programs have concentrated on teaching general search techniques along with an introduction to the Medical Subject Headings (MeSH). While the Alfred Taubman Medical Library (TML) of the University of Michigan (UM) followed this national trend, TML librarians also began to ask important questions: What was the impact on the health professionals of learning bibliographic database searching as part of their instructional program? Did practitioners have an opportunity to use these skills in their professional practice? To answer these and several other questions on end-user search training for health professionals, a follow-up study of graduates of the College of Pharmacy was conducted.

The College of Pharmacy at UM required that all third-year pharmacy students complete the course "Drug Information and Scientific Literature Evaluation." The original objective was to introduce students to printed sources of drug information; but recognizing that information tools and sources were changing, the college wanted to include a unit on online sources of drug information. The course instructors agreed that TML librarians would be responsible for developing and teaching the unit.

The program began in 1983–1984 when third-year pharmacy students were taught the basics of online searching using MEDLINE. Working in pairs, students completed MEDLEARN, a computer-assisted instruction program that taught the user how to search the MEDLINE database of the National Library of Medicine (NLM). After completing MEDLEARN, students attended a lecture about the difference between online and manual searching. Other topics covered included Boolean logic, facet analysis, and future trends in online searching. To meet the original course objective to give in-depth training in using several printed indexes, students were assigned a series of questions to answer from *Index Medicus* and *International Pharmaceutical Abstracts* (IPA). The final element in the search training was to have each student request a mediated search from a TML reference librarian. Arrangements were made for students to be present when the search was run so that they could observe the process.

In 1984–1985, MEDLEARN was eliminated. A half-hour lecture describing the basics of online searching was coupled with a ninety-minute hands-on training session with the BRS Colleague search system. (BRS generously contributed the online time needed to train the students.) Students searched MEDLINE and IPA in pairs to answer preassigned drug information questions.

Between 1984–1985 and 1987–1988, little substantive change was made to the presentation. Detailed handouts describing BRS system features and background information on the MEDLINE database and the MeSH thesaurus were distributed. In 1986–1987, when the College of Pharmacy was required to underwrite the cost of online search training time, BRS Menu was selected because the overall cost was lower than that of BRS Colleague. Each year, students were assigned search questions by librarians or course instructors. The average class size during the period was forty-two.

For the first four years of the program, the students' evaluations were consistently favorable, and each class recommended that the unit on online database searching be continued. In 1987–1988, negative evaluations were received. This was also the first time that actual searches previously requested by UM hospital pharmacists were assigned to the students as practice questions. An analysis determined that these searches were probably too complex for beginning students. In the 1988–1989 academic year, PaperChase was made available to all UM students, faculty, and staff at no charge, and it became the instructional medium.

Despite changes in formats and systems used, the objectives of the class remained the same: Namely, students would be introduced to computerized information systems, know when a computerized search was more appropriate than a manual search, be capable of formulating a simple search strategy using Boolean logic, be familiar with the databases that provide coverage of the pharmacy literature, and be capable of running a MEDLINE search using a user-friendly interface.

SURVEY METHODOLOGY

In the spring of 1989, a survey was conducted among students who had completed the Pharm.D. degree between 1985 and 1988. The survey was designed to assess the impact of teaching online literature searching on pharmacy students. The five objectives of the study were to determine the practicing pharmacist's level of familiarity with computerized sources of bibliographic information, to assess the patterns of utilization of computerized resources, to assess the satisfaction with computerized resources, to gauge the current interest in learning about computerized forms

Table 1
Work/study settings (n = 90)

Setting	Number (%)*
Hospital	47 (52%)
Academic research/teaching	11 (12%)
Chain pharmacy	9 (10%)
Other	9 (10%)
Pharmaceutical company	7 (8%)
Independently owned pharmacy	7 (8%)
Outpatient clinic	4 (4%)
HMO pharmacy	4 (4%)
Government	4 (4%)
Residency training	4 (4%)
School program (e.g., Ph.D.)	2 (2%)
Total	108

* Some respondents checked more than one setting.

of information, and to solicit suggestions and feedback about the course.

This paper does not attempt to cover all of these objectives. It focuses on the survey population's computer literacy and computerized literature searching, making some comparisons between the four subgroups studied: end users, those who used intermediaries, those who used both methods of literature retrieval, and those who did not use these services.

The survey and its findings join several other studies on end-user searching in the health sciences, including Sewell and Teitelbaum's series on pharmacists and pathologists at the University of Maryland [5–8], the survey of MEDLARS and GRATEFUL MED end users by NLM [9], and studies by Poisson [10], Ludwig et al. [11], Starr and Renford [12], Soben and Wilson Green [13], Cornick [14], and Kirby and Miller [15]. The study reported here supports the findings of previous research.

The survey was conducted between March 27 and May 1, 1989. The written, self-administered questionnaire was composed of a variety of question-and-answer formats, including finite answer, rank-order answer, open-ended answers, and "pick all that apply." There were two mailings: an initial mailing that included the cover letter and survey, and a follow-up postcard for those who had not responded three weeks after the first mailing. The total population (n = 151) of the four graduating classes was targeted; the final return rate was 60%, or ninety usable questionnaires.

RESULTS

The initial questions asked the graduates to rank all the information resources they used on a regular basis. The highest-ranked information resources were annually updated pharmacy references, journals, books, and colleagues. Computerized resources, in-

cluding literature searching, ranked somewhat lower. The indexes and abstracts category also ranked fairly low. Print materials that contained very current information or that were updated regularly were the primary information resources.

To determine how they used computers in their work and study settings, participants were asked to check off the types of programs they used. Results included word processing, drug preparation and distribution, drug information (e.g., literature searching), telecommunications/electronic mail, disease information (e.g., literature searching), spreadsheets, database management, statistical data analysis, financial management software, "other," and "none." Approximately 98% (n = 88) of the respondents used computers. On the average, each used 3.78 computer applications. Eighty percent (n = 72) of the respondents used word-processing software, 72% (n = 65) used drug preparation and distribution software, and 59% (n = 53) used drug information programs. From this data, it seems reasonable to conclude that the survey group was computer-literate.

Fifty-two percent (n = 47) of the graduates were employed as hospital pharmacists and 12% (n = 11) worked in an academic, research, or instructional setting (Table 1). The work environment of most respondents may well have influenced their access to and support for end-user searching. The study's goal had been to correlate work or study setting with searching and search characteristics, but due to data-input format difficulties and time constraints, those calculations were not completed.

The survey questionnaire divided the respondents into four subgroups to determine how the answers differed. The four subgroups were end-user searchers, users of intermediary searchers, those end users who also used intermediaries, and those who did not use computerized literature searching. Seventy-two percent (n = 65) of the respondents used computerized literature searching in some capacity, while approximately one fourth (n = 25) did not use literature searching. Forty-two percent (n = 38) performed their own searches (Table 2).

Comparisons of the four subgroups

The four groups differed from one another in general computer use, familiarity with MEDLINE search terminology, general information use, reasons for using or not using literature searching, and search characteristics (type, time frame, amount, frequency).

General computer use

As discussed above, the overall sample group was computer-literate. When the four subgroups were analyzed, some interesting trends emerged. Those who used computerized literature searching were more

Table 2
Computerized searching (n = 90)

Search subgroup	Number (%)
End user only	10 (11%)
Intermediary only	27 (30%)
End user and intermediary	28 (31%)
None	25 (28%)
Total	90 (100%)

Table 3
Average number of computer applications (n = 90)

Search subgroup	Number*
End user only	5.50
End user and intermediary	4.79
Intermediary only	3.52
None	2.24

* Range of zero to ten applications.

likely than the other groups to use a greater number and variety of other computer applications. The end users were more likely to use a greater number of computer applications than those who used only an intermediary to do their literature searches (Table 3). The four subgroups were significantly different from one another, as indicated by the test of analysis of variance (ANOVA) at a 95% confidence level.

Familiarity with MEDLINE search terminology

The questionnaire asked participants whether they recognized certain search terms, each of which had been encountered in the drug information course. Some were related to MEDLINE, while others were generic online search terms. The rate of recall was fairly high. Sixty-two percent (n = 56) recognized seven to eleven of the eleven terms. The most frequently identified terms were some of the most commonly used online search terms, e.g., MEDLINE, database, subject heading, and computer literature searching. The least frequently recognized terms can best be described as jargon; they included explode capability, Boolean operators, and limiters. These terms are probably less important to the end user's vocabulary because many system interfaces provide user-friendly access to these techniques.

Statistically significant differences in the average number of terms recognized in the four groups were apparent through ANOVA at a 95% confidence level (Table 4). Respondents who did their own searches recognized more terms than those who used only intermediaries or those who did not search by either method. That finding was expected. The more closely individuals work with a system, the more familiar they become with the terminology. It was encouraging, however, that even the respondents who did not search recognized more than half of the terms. It must be remembered that recognition does not indicate understanding nor even a working knowledge of the terms.

General information use

The graduates were asked how they used information in their present work or study setting. The list of choices included continuing education, research, ac-

ademic curriculum, patient education, clinical information, "other," and "I do not have occasion to seek information in my present setting." Participants were asked to check all that applied.

Overall, clinical information was the most common use, followed by continuing education, patient education, research, and academic information (Figure 1). The people who used computerized resources used the information for academic and research purposes more often than those who did not use computer searches. The subgroup that sometimes did its own searching and sometimes used an intermediary reported seeking research and academic information at a higher rate than the other two searching subgroups. Use of information for clinical needs and continuing education occurred evenly across the subgroups and, therefore, did not correlate to computerized searching. The people who did not use computerized resources, however, indicated that they sought information for continuing education and patient education more frequently than the other subgroups. It can be hypothesized that research and academic information is more readily available in computerized format than patient and continuing education materials. Academic and research environments also may be more likely to offer computerized resources.
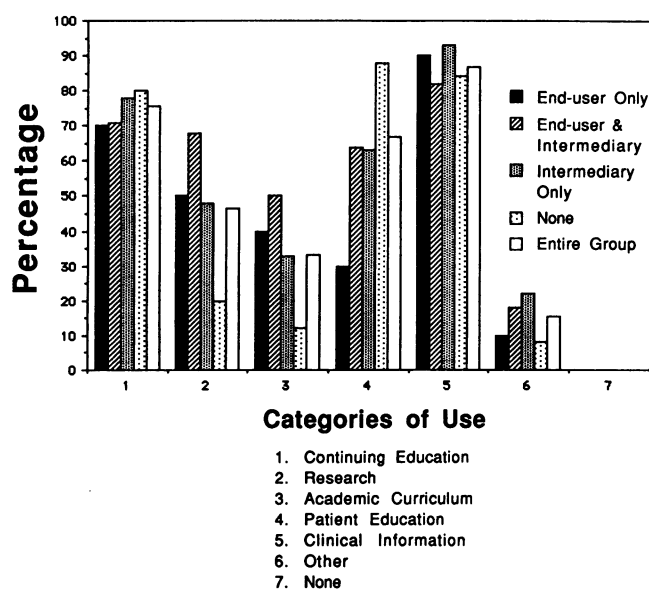
Reasons for using or not using search services

All respondents were asked why they used or bypassed search services. A list of answers was provided, along with the option "other" and an opportunity to

Table 4
Average number of terms recognized (n = 90)

Search subgroup	Number*
End user only	9.60
End user and intermediary	7.82
Intermediary only	7.04
None	6.04

* Range of zero to eleven terms.

Figure 1
Information use

Categories of Use

1. Continuing Education
2. Research
3. Academic Curriculum
4. Patient Education
5. Clinical Information
6. Other
7. None

fill in a blank. More than one category could be checked. The people who used only end-user searches checked "convenience," "speed," "easier to search than explain," and "enjoy searching" as reasons for doing their own searches. The lack of access to an intermediary searcher was not significant to this group. It seems likely that these people search because they enjoy the activity. The people who used both end-user and intermediary searches checked "convenience," "speed," "less expensive," and "know best how to search" as the reasons for doing their own searches. "Enjoyment of searching" was selected less often by this group than by the first group. The people who used only intermediary searches checked "convenience," "lack access to computer to search," "intermediary better searcher," and "speed of access" as reasons for having an intermediary search for them. The end-user group that also used intermediaries occasionally checked "convenience," "no time to search," "intermediary better searcher," and "to double-check own searching" as reasons for using an intermediary. The survey indicates that this group may use the services of an intermediary when pressed for time or to run a more difficult and involved search. The people who used only intermediaries reported that they used these services because there was no alternative, to save time, or because they did not trust their own skills. The nonsearching group checked "lack of access to a computer," "lack of access to an intermediary," "lack of access to assistance with

searching," and "do not need computerized searching" as the reasons for not using computerized literature searching. Lack of awareness about computerized search capabilities ranked very low.

Characteristics of searches

The respondents who used searching (end-user or intermediary) in some capacity were asked whether they most frequently ran subject, author, citation verification, or other types of searches. The answers were similar whether searches were executed by the end user or run by an intermediary. Subject searches were overwhelmingly the most frequent choice for all three search subgroups.

Included was a question on the time frame most frequently searched, e.g., current, current and older, older, and "other." The end-user and intermediary-user subgroups selected the current and older category most frequently, followed by current material only. Interestingly, the end users who always conducted their own searches requested current and older searches more than the other subgroups. By contrast, the end users who sometimes used intermediaries reported that they searched for current materials themselves, but used intermediaries to search for current and older materials. None of the subgroups checked only older materials; that reflects the emphasis in drug information on current and up-to-date information. Overall, the use of computerized literature searches for both current and retrospective information may indicate that the respondents did not perform literature searches to obtain information at the cutting edge.

The respondents were queried as to the amount of information they normally wished to obtain from a search (i.e., 1–3 references, 4–20 references, 21–50 references, more than 50 references, all relevant articles available). All three subgroups that searched wanted 4–20 references. End users, including those who sometimes used intermediaries, ranked 1–3 references next highest when they searched for themselves. This may indicate that end users search when they are seeking a few relevant articles on a topic. When intermediaries are used, all relevant references is the next highest category. This indicates a heavier reliance on intermediaries for comprehensive searches.

The respondents were also queried about how often they searched. The categories were more than once a week, approximately once a week, once or twice a month, every few months, once or twice a year, and "other." The end-user-only subgroup searched about once a week. The end users who also used intermediaries generally searched once or twice a month as end users. Both of these groups requested searches from intermediaries every few months.

End users tended to search more frequently than those who had intermediaries search for them. The end-user-only group searched more frequently than the other groups. It is evident that the intermediary-only group searched less frequently. Those who used both end-user and intermediary searches tended to search less frequently as end users than those in the end-user-only group, but they requested more intermediary searches than those in the intermediary-only group.

The variation may be attributable to convenience. Those who rely solely on their own searching may search more frequently as they become comfortable and familiar with a system that is readily available. Those who use both forms of searching may seek assistance from an intermediary when they are not able to search for themselves; they can conduct simple and quick searches whenever they wish. Those who use only intermediaries may forgo searches because of the effort and planning required.
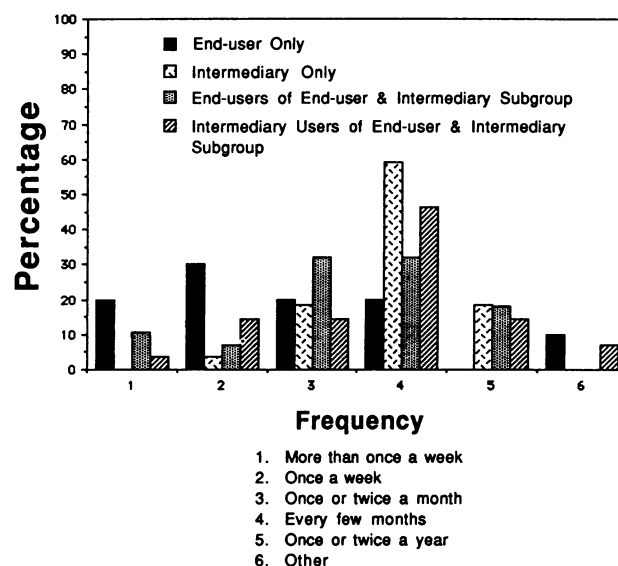
CONCLUSIONS

Providing hands-on instruction in the use of online databases, a course called "Drug Information and Scientific Literature Evaluation," offered during the third year of pharmacy school, had a significant impact on the respondents to this survey. A large number of pharmacists continued to perform their own computerized literature searches or to use the services of an intermediary as many as five years after completing the Pharm.D. degree. In addition, there was a high level of recognition of online search terminology among the participants. Survey feedback strongly supported continuing the unit and suggested more hands-on experience with computerized searching and more exposure to other computerized drug information sources, including factual databases such as Micromedex CCIS. The 60% response rate must be considered in the interpretation of these findings; if a large number of the nonrespondents did not use end-user or intermediary search services, the results could have been quite different.

The results of this study imply that literature searching plays a secondary or tertiary role in meeting the information needs of pharmacists. However, the data point to some interesting hypotheses about computer use and end-user searching. Those who know how to use several computer systems are more likely to be comfortable conducting their own searches; and those who can use several computer systems are likely to work in environments where a wide range of technology is available, including end-user search systems.

The survey findings agree with other health sciences end-user studies with regard to the percentage of the population that continues searching, the rea-

Figure 2
Frequency of searching

Frequency
1. More than once a week
2. Once a week
3. Once or twice a month
4. Every few months
5. Once or twice a year
6. Other

sons for searching and not searching, the heavy use of subject searching, the current citation time frame, and the frequency of searching. It is hypothesized that those who do all of their own searching tend to be a self-sufficient group who search fairly frequently to satisfy various information needs; they probably consider searching an enjoyable activity. The people who do both end-user searching and intermediary searching appear to use an intermediary only as a complement to their own efforts. They search on their own less frequently than the previous subgroup. The subgroup that uses only intermediaries requests searches less frequently than the subgroups with end users. The subgroups that use searches in some capacity may be more closely connected to research and academic environments. The people who do not use computerized searches probably do not have access to end-user resources nor an intermediary; they may work in more strictly clinical settings.

This survey of pharmacists suggests that computerized forms of information seeking have gained widespread acceptance among health scientists. It is assumed that the proportion of end-user searchers will continue to rise as students with a wider range of computer skills enter the field.

Integrating computerized literature search instruction into the curriculum has proved to be an effective method for introducing searching to health professionals. Instruction and end-user support, however, should not be limited to the initial training. Survey feedback expressed a great interest among users in

follow-up training and continued support. The current challenges are to support end users through workshops and instruction in advanced techniques and to reach those who do not search. Studies by McKibbon et al. [16] and Haynes et al. [17] discuss the need for extensive training and ongoing support to help end users become proficient. Librarians and information specialists need to market themselves as consultants to end users with difficult searches and as experts to those who do not search for themselves. For example, although the end-user subgroups kept abreast of current information through frequent searches, how effective are their searches? Is the information they retrieve adequate, and are the databases they search the best source of information for the query? As the availability of databases on local networks and in individual laboratories and offices increases, the groups that use intermediaries should be encouraged to explore end-user searching to keep up with the rapidly expanding body of health sciences information. As more information and bibliographic resources are converted to computerized forms, the initiation, instruction, and continued support of older as well as younger pharmacists in their use will become even more critical.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the guidance and assistance received in carrying out this research project from Dottie Eakin (then acting head, Alfred Taubman Medical Library; presently director, Medical Sciences Library, Texas A&M University); Dr. Karen Markey Drabenstott, School of Information and Library Studies; and Dr. Frank Ascione, College of Pharmacy, both at the University of Michigan.

REFERENCES

1. MATHESON NW, COOPER JAD. Academic information in the academic health sciences center: roles for the library in information management. J Med Educ 1982 Oct;57(10, part 2):1–93.
2. Physicians for the twenty-first century: report of the project panel of the general professional education of the physician and college preparation of medicine. J Med Educ 1984 Nov;59(11, part 2):1–208.
3. IBID., 13, 63.
4. WOOD EH, MORRISON JL, OPPENHEIMER PR. Drug information skills for pharmacy students: curriculum integration. Bull Med Libr Assoc 1990 Jan;78(1):8–14.

5. SEWELL W, TEITELBAUM S. Preliminary observations of non-mediated search behavior of pathologists and pharmacists. In: Proceedings of the American Society for Information Science, Columbus, Ohio, Oct. 17–21, 1982. Columbus, OH: The Society, 1982;19:276–8.
6. TEITELBAUM S, SEWELL W. Survey of attitudes of pathologists and pharmacists toward nonmediated online searching. In: Proceedings of the Annual Meeting of the American Society for Information Science, Columbus, Ohio, Oct. 17–21, 1982. Columbus, OH: The Society, 1982;19:298–300.
7. SEWELL W, TEITELBAUM S. Observations of end-user online searching behavior over eleven years. J Am Soc Inf Sci 1986 Jul;37(4):234–45.
8. SEWELL W. Overview of end user searching in the health sciences: an opinion paper. In: Wood MS, Brassil Horak E, Snow B, eds. End user searching in the health sciences. New York: Haworth Press, 1986:3–14.
9. NATIONAL LIBRARY OF MEDICINE. Survey of individual users of MEDLINE. Bethesda, MD: The Library, 1988 November.
10. POISSON EH. End-user searching in medicine. Bull Med Libr Assoc 1986 Oct;74(4):293–9.
11. LUDWIG L, MIXTER JK, EMANUELE MA. User attitudes toward end-user literature searching. Bull Med Libr Assoc 1988 Jan;76(1):7–13.
12. STARR SS, RENFORD BL. Evaluation of a program to teach health professionals to search MEDLINE. Bull Med Libr Assoc 1987 Jul;75(3):193–201.
13. SOBEN P, WILSON GREEN E. GRATEFUL MED searching: a hospital library perspective. Med Ref Serv Q 1988 Fall;7(3):35–43.
14. CORNICK D. Being an end-user is not for everyone. Online 1989 March;13(2):50, 53.
15. KIRBY M, MILLER N. MEDLINE searching on Colleague: reasons for failure or success of untrained end users. Med Ref Serv Q 1986 Fall;5(3):17–34.
16. McKIBBON KA, HAYNES RB, WALKER DILKS CJ, RAMSDEN MF ET AL. How good are clinical MEDLINE searches? A comparative study of clinical end-user and librarian searches. Comput Biomed Res 1990 Dec;23(6):583–93.
17. HAYNES RB, McKIBBON KA, WALKER CJ, RYAN N ET AL. Online access to MEDLINE in clinical settings. A study of use and usefulness. Ann Intern Med 1990 Jan;112(1):78–84.